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Letter to the Editor

Multicolour Far Infrared Photometry of Galactic H II Regions

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Summary. Results are presented of far infrared photometric measurements of some galactic H II regions in the galactic plane between longitudes 350° and 40°.

Key words: far-infrared photometry – H II regions

Since the balloon flight in 1972 (Olthof and van Duinen, 1973, here after called Paper I), we obtained new data during three successfull flights in 1973. The gondola, which was the same as described in Paper I, has been launched in the south of France in cooperation with the French Space Research Organisation C.N.E.S. on June 7, 16 and July 2, 1973.

The wavelength bands we have flown up to now are given in Table 1.

Table 1. Wavelength bands used during balloon flights in 1972 and 1973

Flight	Wavelength bands	
1972	71– 95 μ	84–130 μ
1973 I	71– 95 μ	30– 38 μ
1973 II	71– 95 μ	114–196 μ
1973 III	111–154 μ	30– 38 μ

For calibration Jupiter has been observed during all flights. The beam size was 0.5 degree for all flights.

Flight 1972

Due to identification problems, some results given in Paper I have to be modified. A re-analysis of these data has shown that we could not have observed M 17 since this source was outside our scanned area. Furthermore, the signals identified with W 31 and W 33 have been confused. As a result the number given for the 84–130 μ band for W 31 was too high and the number given for W 33 was too low. The results of this flight based on the re-analysis are included in Table 2.

Flight 1973 I

Due to electronical problems no results were obtained with the 30–38 μ channel for 2/3 of the flight. Only in the last part of this flight this channel has given

Table 2. Deduced mean fluxes based on T_{BB}(Jup) = 140 K in units of 10^{-9} W m^{-2}

Source	30–38 μ	71–95 μ	84–130 μ	111–154 μ	114–196 μ
NGC 6334		4.80 ± 0.55	6.20 ± 0.55	2.30 ± 0.45	2.75 ± 0.70
NGC 6357		3.05 ± 0.45	3.80 ± 0.65	1.50 ± 0.30	1.85 ± 0.60
NGC 6383		0.75 ± 0.10			0.95 ± 0.35
G 3.2 – 0.5		0.55 ± 0.10			0.65 ± 0.10
M 8		1.20 ± 0.20	1.15 ± 0.20		0.65 ± 0.10
W 30		0.75 ± 0.20	1.15 ± 0.30		0.65 ± 0.15
W 31		1.30 ± 0.20	1.45 ± 0.30		0.95 ± 0.30
W 33		1.65 ± 0.20	2.30 ± 0.40		1.25 ± 0.35
M 17	8.30 ± 1.50	5.80 ± 0.75		2.30 ± 0.45	2.75 ± 0.70
M 16		1.30 ± 0.20			0.95 ± 0.35
W 35		0.75 ± 0.10			0.65 ± 0.30
W 39		0.85 ± 0.30			0.65 ± 0.30
W 41		0.85 ± 0.20			0.95 ± 0.35
W 42		0.85 ± 0.30			0.95 ± 0.35
W 43		1.65 ± 0.30			1.25 ± 0.35
W 44		0.65 ± 0.10			0.95 ± 0.35
W 40		1.10 ± 0.20			0.95 ± 0.35

reliable results for M 17 and Jupiter. Fortunately this event did not influence the observations in the 71–95 μ band.

Flight 1973 II

This flight was completed without difficulties. Jupiter was observed at elevations 17° and 27° above the horizon in order to determine residual atmospheric absorption at balloon altitudes. At both elevations several scans through Jupiter were made. In both cases the mean signal amplitude was the same within the 10% r.m.s. error.

Flight 1973 III

Due to degradation of the system only the strongest sources could be observed.

Observations

Several scans, with the 0.5 degree beam, have been made through each source. Using the position information from the scanning mirror, the azimuth error from the servo system, the time recorded simultaneously with the photometer output and the position of the gondola as obtained during the flight, each obtained signal is transformed to its celestial coordinates. Due to residual pointing errors the signals, attributed to the same source, show variation in amplitude in different scans. A statistical analysis of the source signals with respect to the signals of Jupiter, for which a black-body temperature of 140 K has been used, led to the results given in Table 2. For the 71–95 μ band an average has been taken for the flights which included this filter.
The same has been done for the observation of M 17 in the 30–38 μ band.

Discussion

Comparison of our results with earlier measurements on some of these sources by Hoffmann *et al.* (1971) is somewhat difficult, because these authors give their results in flux densities. However, multiplying these flux densities by the frequency content of the quoted wavelength bands, it is evident that our results are factors 2 to 3 larger than the results obtained by Hoffmann *et al.* These differences might be attributed to the combined effects of beamsize and observing technique. Hoffmann *et al.* have observed with a beam of 0.2 degree using a differential beam switching technique. This small throw beam switching technique suffers from decreased sensitivity to areas of emission that have a low value of the intensity gradient. We have scanned through the sources with a 0.5 degree beam. This rapid scan technique utilizing a large beam is much more sensitive to extended sources.
Taking into account these considerations we conclude that the surface brightness distribution is generally peaked with an extended background. This conclusion is supported by the results of Soifer *et al.* (1972) of NGC 6357 which shows this source to be extended while Hoffmann *et al.* classify this object as two point sources. Also the maps of Emerson *et al.* (1973) show a clearly peaked intensity distribution with an extended background. A general analysis of the maps of NGC 6334 and NGC 6357 produced by Emerson *et al.* shows that the contribution of the peaks in the intensity distribution is of the order of 20 to 50% of the total source fluxes.
In both cases the contribution of the more extended lower flux levels is appreciable. The interpretation of the measurements in this way might be considered to support the picture described by Wright (1973) who shows that a dust depleted H II region will show two distinct maxima in the spectrum corresponding to different dust temperatures inside and outside the ionized region. Note that Emerson *et al.* (1973) could not separate both contributions due to the width of the wavelength band used.
Detailed maps at different discreet far infrared wavelength bands are necessary to determine the temperature and the distribution of the radiating dust particles.

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References

Emerson, J. P., Jennings, R. E., Moorwood, A. F. N. 1973, *Astrophys. J.* **184**, 401
Hoffmann, W. F., Frederick, C. F., Emery, R. J. 1971, *Astrophys. J. Letters* **170**, L 89
Olthof, H., van Duinen, R. J. 1973, *Astron. & Astrophys.* **29**, 315
Soifer, B. T., Pipher, J. L., Houck, J. R. 1972, *Astrophys. J.* **177**, 315
Wright, E. L. 1973, *Astrophys. J.* **185**, 569

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